Sheldrake, Sean

From: BAYUK Dana <BAYUK.Dana@deq.state.or.us>
Sent: Friday, June 26, 2015 1:13 PM
To: 'Pradeep Mugunthan'
Cc: John Edwards; Binglei Gong; Ben Hung; John Renda; Mike Riley; Carl Stivers; Rob Ede; 'James Peale'; 'Mike Murray'; Sheldrake, Sean; 'Peterson, Lance'; Coffey, Scott; Gamache, Matthew; LARSEN Henning
Subject: RE: Gasco Monthly Technical Source Control Call - Presentation for Today's Call
Attachments: CDM_Smith_Memo_23JUNE2015.pdf

Hello Pradeep.

DEQ reviewed the model update presentation materials that Anchor provided on June 15, 2015. The materials provide DEQ and EPA with an update on the status of groundwater modeling work completed since the previous update on April 20, 2015. The June 15th presentation substantially expands on previous presentations and much of the presentation consists of information provided for the first time.

Slide #57 of the June 15th presentation summarizes the status and proposed next steps in the modeling process. Based on the slide and discussions during the presentation, DEQ understands that NW Natural:

- Concludes that model calibration is complete for the Alluvium WBZs;
- Recommends proceeding to the model sensitivity analysis and validation (validation using Phase 1, Step 5 data) ;
- Is developing particle tracking simulations to assess system performance during Phase 1 and Phase 2 testing;
- Proposes refining the model for the Fill WBZ using a seepage face approach; and
- Proposes beginning the report documenting the model.

During the June 15th discussions we agreed that:

- DEQ's approval was needed on the first two items in the list above;
- DEQ's approval was not needed for the third item as the particle tracks are functionally a part of the model; and
- Anchor should proceed with incorporating the seepage face approach for the Fill WBZ into the model.

Report preparation was not specifically discussed on June 15th.

Regarding the first two items in the list, the primary purpose of this e-mail is to inform NW Natural that based on the June 15th discussions and our review of the presentation materials , DEQ does not approve calibration of the Alluvium WBZs. Consequently, DEQ also does not approve moving forward with the sensitivity analyses and model validation.

DEQ is not approving calibration of the current version of the model primarily for the following reasons:

- The amount of precipitation recharging the Fill WBZ in the uplands portions of the model, and the rate of groundwater flow entering the model domain along the upgradient constant-head boundary appear to be significantly underestimated. The attached memorandum prepared by CDM Smith on behalf of EPA provides the technical basis for DEQ's conclusion. DEQ has reviewed the attachment and concurs with the conclusions presented.
- Hydraulic conductivity (K) assignments appear to restrict movement of groundwater from the uplands to shoreline extraction wells. DEQ observes that the uplands K-values in the Gasco groundwater model have been reduced significantly during the calibration process. For example, in the July 2013 version of the Model Update Report the horizontal K-value assignments in the Upper Alluvium WBZ, Lower Alluvium WBZ, and Deep Lower Alluvium WBZ ranged from 100 to 1,250 feet/day. Slides 40, 41, and 42 of the June 15th presentation now show the K-values assigned to these three WBZs as ranging from 3 to 15 feet/day (note that the 200/20 feet/day Zone 24 shown in Slide 42 is not relevant as it is largely outside the deep lower alluvium active zone). Currently the uplands K-values assigned to the Alluvium WBZs are significantly lower than:
  - Assignments near the river in the Gasco model;
  - Estimates based on extraction well tests (e.g., Lower Alluvium WBZ K-values are 20-30 times less than the geometric and/or arithmetic means derived from the tests); and
  - Values used in the USGS model.

  DEQ concludes that reducing uplands K-values is indicative of the need to raise groundwater heads without increasing groundwater flow through the system. DEQ also concludes that the combination of underestimating recharge and the use of low-K values limits the amount of uplands groundwater available to the HC&C system. This combination of factors results in the model reaching out to and under the river to meet the demands of pumping the HC&C system extraction wells.
- The model over predicts the influence of the HC&C system on water levels in the Fill WBZ. DEQ concludes this is the result of placing unadjusted horizontal and vertical K-values for the Upper Alluvium WBZ directly below the fill where the "upper silt unit" is interpreted to be thin or absent. As a result, model simulations contradict data collected along the shoreline that indicate:
  - The hydraulic properties of the upper-most Alluvium WBZ beneath the upper silt unit and/or the Fill WBZ are lower than the upper Alluvium WBZ; and
  - There is limited hydraulic connection between the Fill WBZ and the Upper Alluvium WBZ, if any.

  Based on Slide #53, DEQ believes this comment applies to portions of both the Gasco Site and the Siltronic Site.

In summary, DEQ does not approve the current version of the model for the following reasons:

- Underestimating recharge and groundwater flux in the uplands portions of the model necessitates the use of low K-values to calibrate heads in the Alluvium WBZs.
- The combination of underestimating recharge and using low-K values: 1) limits the amount of uplands groundwater available to the HC&C system; and 2) results in model simulations that show the HC&C system reaching out to and under river to meet the extraction rates.
- Model simulations over predict the hydraulic influence of the HC&C system on the Fill WBZ and contradict available information and data that indicate the hydraulic connection between the Fill WBZ and Upper Alluvium WBZ is limited.

The groundwater model is being used to evaluate the performance and effectiveness of the HC&C system for uplands groundwater source control. In addition, the model is being used for planning and designing the in-water sediment project. Given this information, it is important for model input parameters to be representative of conservative conditions based on available information, observations, and site data. In DEQ's view, underestimating recharge to the Fill WBZ

and Alluvium WBZs, using low K-values in the uplands, and assumptions that indicate there is a hydraulic connection between the Fill WBZ and Alluvium WBZs make the model non-conservative overall.

Based on this information, DEQ believes that modifications to key parameters and model recalibration are warranted. Modifications to the model should include, but are not necessarily limited to the following:

- Groundwater flows along the upgradient constant head boundary should be increased by an additional minimum of 300-500 gpm. Uplands K-values in the Alluvium WBZs should be increased accordingly to calibrate the model to the increase in recharge.
- Recharge to the Fill WBZ by precipitation in pervious areas should be increased to at least 20-inches per year.
- Areas within the model where the silt unit is thin or absent should use the horizontal and vertical K-values for the silt until such time as data is developed to indicate otherwise.

(b) (6) Please feel free to contact me to arrange a call to discuss this e-mail. I don't know the availability of the EPA team, but Henning and I are available next Tuesday (6/30) after 330pm and from 1-3pm on Wednesday (7/1) for a call.

Dana

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From: Pradeep Mugunthan [mailto:pmugunthan@anchorqea.com]
Sent: Monday, June 15, 2015 9:52 AM
To: BAYUK Dana; LARSEN Henning; Scott Coffey (coffeyse@cdmsmith.com); Lance Peterson (PetersonLE@cdmsmith.com); Matt Gamache (gamachem@cdmsmith.com); Sean Sheldrake; James Peale; mmurray@maulfoster.com; Mike Riley; John Edwards; John Renda; Ben Hung; Binglei Gong
Cc: Carl Stivers; Rob Ede; Bob Wyatt; Patty Dost; Sarah Riddle
Subject: Gasco Monthly Technical Source Control Call - Presentation for Today's Call

Dana,

As per your request we are sending the presentation ahead of our call this afternoon. Please forward to anyone I may have missed.

Thanks.
Pradeep

Pradeep Mugunthan, Ph.D., P.E.
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Please consider the environment before printing this email.

-----Original Appointment-----
From: Jen Woronets
Sent: Tuesday, June 02, 2015 1:46 PM
To: Jen Woronets; Dana Bayuk; larsen.henning@deq.state.or.us; Scott Coffey (coffeyse@cdmsmith.com); Lance Peterson (PetersonLE@cdmsmith.com); Matt Gamache (gamachem@cdmsmith.com); Sean Sheldrake; James Peale; mmurray@maulfoster.com; Mike Riley; John Edwards; John Renda; Ben Hung; Pradeep Mugunthan; Binglei Gong
Cc: Carl Stivers; Rob Ede
Subject: Gasco Monthly Technical Source Control Call
When: Monday, June 15, 2015 1:30 PM-4:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: (b) (6) and web meeting

Dana, Henning, Scott, Lance, Matt, Sean, James, Mike M., Rob, Mike R., John E., John R., Ben, Carl, Pradeep -

Meeting information

Topic: Gasco Monthly Technical Source Control Call
Date: Monday, June 15, 2015
Time: 1:30 pm, Pacific Daylight Time (San Francisco, GMT-07:00)
Meeting Number: (b) (6)
Meeting Password: (This meeting does not require a password.)

To start or join the online meeting

Go to (b) (6)

Audio conference information

To receive a call back, provide your phone number when you join the meeting, or call the number below and enter the access code.
Call-in toll-free number (US/Canada): (b) (6)
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Access code (b) (6)
Toll-free dialing restrictions: (b) (6)
Pradeep will host this meeting.